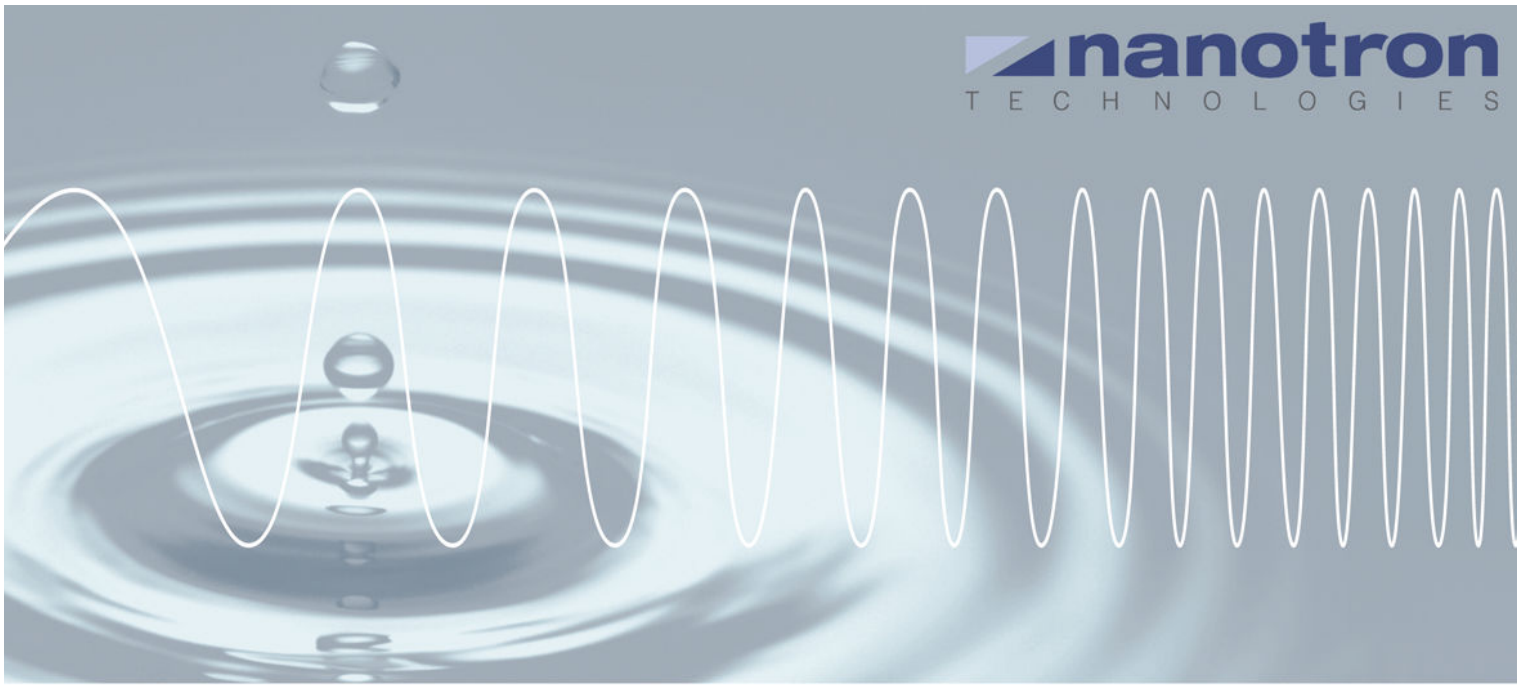

swarm radio Platform *& Interface Description*

1.0

NA-13-0267-0002-1.0

Chirp it.

Document Information

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Document Author:	Dr. Frank Schlichting

Contents

1. Scope

Scope of this document is to describe the embedded *swarm* radio hardware platform and its physical interface to the host controller. The *swarm* radio is accessed by a host platform via a hardware independent Application Programming Interface (API) which is described in a separate *swarm API* document. A swarm is defined as a congregation of independent radios or nodes which share a common interest in their relative positioning and communication towards each other for a certain period of time.

2. Hardware Platform & Interface to Host

2.1. Embedded platform

The following general software requirements have to be met for implementing the embedded software code for elementary ranging functionality:

In order to realize the customer's application requirements and keep the development time to a minimum an existing Nanotron embedded hardware platform has been selected: nanoPAN 5375 DK board with the following specifications

Parameter	Specification
Output power	+ 20dBm = 100mW
Antenna diversity	no
Number of antennas	1
Available interfaces	UART via USB
Indicators	6 LEDs
Keys	3 Keys
Voltage supply	5V USB or 2.8 … 4.0V battery pack
Maximum current drain	< 500 mA
Microcontroller	ATMEL ATMega 1284P
Flash	128 kB
RAM	16 kB
EEPROM	4 kB
RF Transceiver Chip	nanoLOC TRX
Modulation	Chirp Spread Spectrum (CSS)

Tab. 1: *swarm* radio technical data

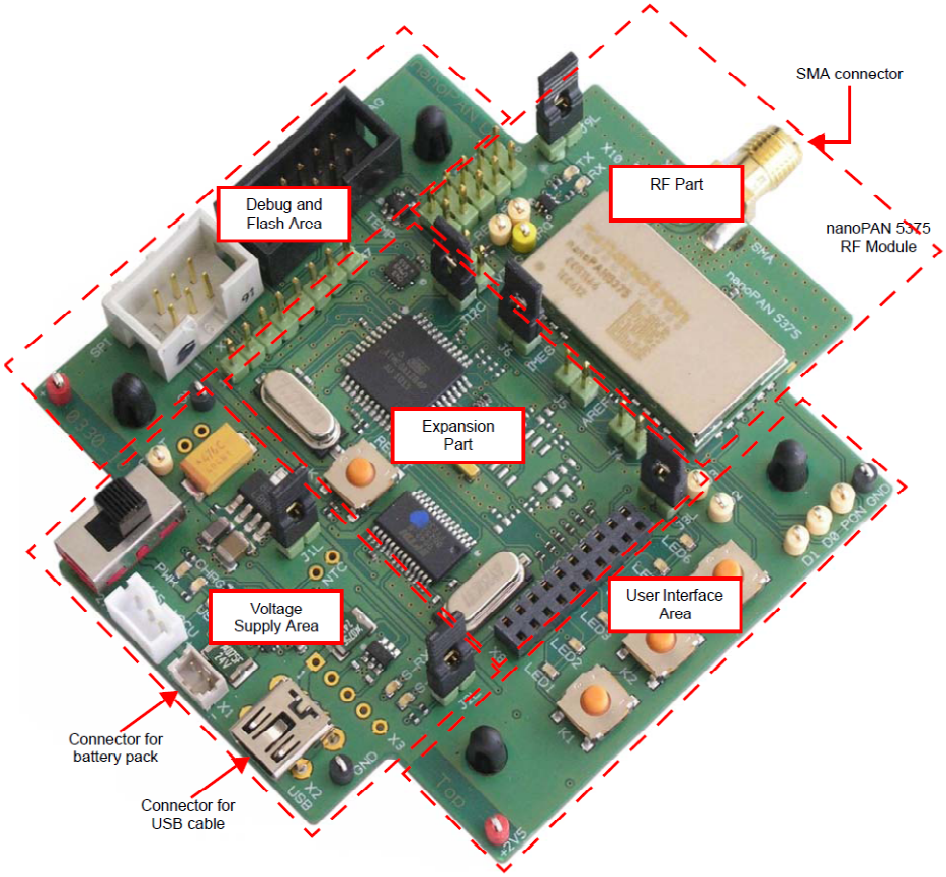

Fig. 2: *swarm* radio based on nanoPAN 5375 DK Board

For the desired customer application set-up a set of minimum two *swarm* nodes are required. Each Unit possesses a unique node ID, which is used to address the ranging partner for the elementary peer to peer ranging operation.

The *swarm* nodes interact with their respective host platforms via their serial interface, e.g. virtual COM via USB or UART port.

2.2. Interface to host

The embedded *swarm* radio platform is connected to its individual host by a standard virtual COM via USB interface with the following settings:

Parameter	Specification
Interface type	Virtual COM via USB
Flow control	off
Data bits	8
Stop bits	1
Available interfaces	1
Parity	None
Data rate	115,2 kbps
Data flow	bidirectional

Tab. 2: Interface specifications between host & embedded platform for virtual COM via USB

2.3. LED / Push button - User Interface

The LEDs available on the *swarm* radio node will be used as live tick and status indicators as follows:

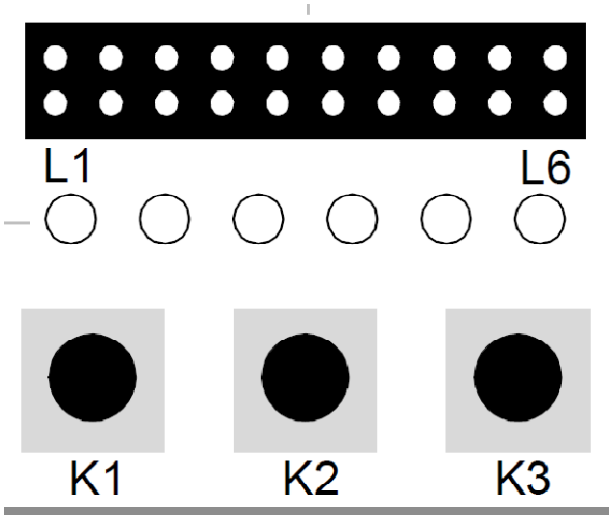

Fig. 3: Location and numbering of the *swarm* radio node buttons and indicator LEDs

LED1:
Function: Node “alive” tick: indicates proper voltage supply and embedded SW running
Interval: 1 Hz blink: 200ms on, 800 ms off

LED2:
Function: Indicating successful elementary ranging cycle successful (Errorcode = 0
Interval: On for 100ms

LED3:
Function: Indicating ranging request from another node
Interval: On for 100ms when request received

LED4:
Function: Indicating ranging error or parameter overflow occurred
Interval: On for 100ms

LED5:
Function: Indicating active / passive / sniffer mode of operation
Status: On for active (default), Off for passive, Blinking for sniffer (on/off: 200ms/800ms)

LED6:
Function: Indicating ID broadcast mode on/off
Status: On for ID broadcast enabled (default), Off for ID broadcast disabled

KEY 1:
Function: Toggle active/passive mode

KEY 2:
Function: Toggle sniffer mode

KEY 3:
Function: Toggle ID broadcast mode on/off

3. Revision History

Date	Authors	Version	Description
2013-02-21	F. Schlichting	1.0	Initial version, extracted from *swarm* API specification document

End of Document

Life Support Policy

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Nanotron Technologies GmbH customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Nanotron Technologies GmbH for any damages resulting from such improper use or sale.

Electromagnetic Interference / Compatibility
Nearly every electronic device is susceptible to electromagnetic interference (EMI) if inadequately shielded, designed, or otherwise configured for electromagnetic compatibility. To avoid electromagnetic interference and/or compatibility conflicts, do not use this device in any facility where posted notices instruct you to do so. In aircraft, use of any radio frequency devices must be in accordance with applicable regulations. Hospitals or health care facilities may be using equipment that is sensitive to external RF energy.
With medical devices, maintain a minimum separation of 15 cm (6 inches) between pacemakers and wireless devices and some wireless radios may interfere with some hearing aids. If other personal medical devices are being used in the vicinity of wireless devices, ensure that the device has been adequately shielded from RF energy. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

CAUTION - Electrostatic Sensitive Device! Precaution should be used when handling the device in order to prevent permanent damage.

FCC User Information

Statement according to FCC part 15.19:
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Statement according to FCC part 15.21:
Modifications not expressly approved by this company could void the user's authority to operate the equipment.

RF exposure:
The internal / external antennas used for this mobile transmitter must provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Statement according to FCC part 15.105:
This equipment has been tested and found to comply with the limits for a Class A and Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation and against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions as provided in the user manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: (1) reorient or relocate the receiving antenna, (2) increase the separation between the equipment and receiver, (3) connect the equipment into an outlet on a circuit different from that to the connected equipment, and (4) consult the dealer or an experienced technician for help.

About Nanotron Technologies GmbH

Nanotron provides reliable loss protection technology and solutions that are used to protect people and animals. Energy efficient, battery-powered wireless nodes are the key building blocks. These small devices create a Virtual Safety Zone which protects tagged people and animals. Robust wireless Chirp technology underpins nanotron's offering of chips, modules and loss protection software for indoor and outdoor environments world wide.

Headquartered in Berlin, Germany, *Nanotron Technologies GmbH* was founded in 1991.

Further Information

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